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ARBOREAL TADPOLES.

BY W. J. HOLLAND.[1]

ON the 20th of July, while engaged at Nikko in collecting entomological specimens, I entered a small field enclosed by a low stone wall near the banks of the Daiya-gawa in the lower part of Iri-machi, not far from the famous red bridge. The field had evidently once been used for growing tea, but had lain neglected for several years, and was partly overgrown by weeds and tangled bushes, among which were a good many willows some of them already twenty or more feet in height. While beating this growth for beetles I observed, pendant from the branches of a thrifty clump of willows, several objects which at first reminded me of hornets' nests save that they were of a light reddish color. They hung over a pool of stagnant water about twenty feet in diameter situated upon what I took to have formerly been the site of a house. A nearer inspection of these objects convinced me that they were not infested by aculeate insects and that in attempting to get at them I would not run any painful risk save that of being mired in the stagnant pool. I observed that one of the objects seemed to be in an apparently decomposing condition, saturated with moisture, and dropping to pieces. Long filaments of slimy froth-like matter were hanging from it, and clinging in streamers from the twigs of the trees just below. I also observed a great many black ants traveling out upon the willow twigs, and a few of them apparently entangled upon the surface of the mass which was falling to pieces. With some difficulty and with the help of a coolie, I succeeded in drawing the most perfect of these objects within reach, and by cutting the willow branches getting it entire to the ground.

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[1] Naturalist of the U. S. Eclipse Expedition to Japan, 1887. Extract from the Report of the Expedition made by Prof. D. P. Todd and presented by Prof. Simon Newcomb, at the meeting of the National Academy of Sciences, April 19, 1889.

I was quite confident that it was of insect origin and my curiosity to ascertain its nature and structure was great. I asked the coolie what it was. His reply was the usual "Wakarimasen," *Anglice* "don't know." The outer surface was dry and had the appearance of very thin brown wafer. At the places where the willow twigs passed in and out of the mass there were projecting points and at the apices of these in several instances there was an exudation of glairy matter, which had the appearance of very fine soap suds. All over the exterior were the bodies and wings of small insects which had evidently been entrapped in the mass when it had been soft. A few ants and flies were struggling in the bubbly, vesicular scum, which was freshest near one or two of the branches at their insertion into the mass, as I have described. Taking my pocket knife I opened the curious structure and found its interior to be composed of a mass of tough, glairy, froth, resembling the white of an egg that has been well beaten, but of a dirty, yellowish brown color. What, however, was my amazement to find scattered through it, and wriggling about hither and thither, a colony of tadpoles, of which I counted twenty-two. They were black in color with white bellies, exceedingly lively, and apparently, very much at home. Here and there in the mass were the remains of insects, principally legs and wings and the chitinous outer coverings of the abdominal and thoracic segments of black ants.

Having no means of preserving the tadpoles with me, as I had hastily gone to Nikko with Professor Todd, leaving my alcohol behind me at Tokio, I resolved to let the best of the remaining two nests remain until the morning of the 22d, when I resolved to secure it, and if possible take it with me to Tokio. I however took down the largest of the two remaining nests, which was already beginning to drop to pieces. In this were also a few tadpoles. A diligent search of the pool failed to reveal any tadpoles in its shallow, miry depths. The next day I revisited the spot. The nest I had designated for myself still remained undisturbed upon the branches, but was drenched with the passing showers. It rains at Nikko in July every day beginning about noon. I made a rough sketch of the object. The following day I repaired to the spot to get the nest, and also armed with a large jar kindly provided by Dr. Whitney, into which to put the tadpoles, and scum should it come to pieces. Unfortunately during the night the elements had made partial wreck of the coveted prize. It was broken in places and hanging down in wet streamers. I took a number of these with the enclosed tadpoles and put them into the jar. But soon they dried up. All that I had left to me was a mass of partly desiccated scum, with some dead tadpoles in it. I allowing this to dry out hard and in this state brought it home to America.

Upon examination I find that the tadpoles have been preserved in the mass in a highly desiccated condition. When alive they were about three quarters of an inch in length. In their dried form they are, it is needless to say, much smaller. By immersing in a mixture of glycerine and water, I have succeeded in partially restoring the form to one or two of them. These with the bulk of the dried froth I have sent to Prof. Edw. D. Cope, of Philadelphia, who assures mé that the phenomenon I have observed is one of much novelty.[1]

Chiromantis guineënsis is said to deposit its eggs upon the branches of trees on the margin of streams in Western Tropical Africa, surrounding them by a frothy, viscous mass of matter, which is dissolved by the moisture in the rainy season when they become detached and drop into the water where they are hatched. A similar phenomenon has been observed in the case of one of the Hylidæ which has its habitat in Southern Brazil; but in neither case has it been observed that the eggs hatch while attached to the trees. In the case of the Japanese Batrachian it is plain that the hatching takes place upon the trees and the larva possibly undergoes some of its transformations in the nidus suspended among the branches. Whether the glairy mass is due to the swelling, under the action of the semi-tropical rains, of material deposited by the female at the time of oviposition I cannot tell. As against this view is the fact that the dried scum after prolonged soaking in water fails to regain its old vesicular, bubbly form. It may be that the froth is secreted by the bodies of the tadpoles themselves, or that both the tadpoles and the parent batrachian are concerned in its production The large quantity of the mass favors the latter view. The nests were fully a foot in diameter. The presence of dead insects in large numbers in the midst of the masses as well as adhering to its outside suggests that the tadpoles feed upon these.

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[1] Since writing the above I have received a letter from Professor Cope, from which I make the following extract :

"The larvæ are different from those of terrestrial Batrachia in possessing a large hypoblastic yolk, the only approach to such condition having been describen in the Genus Alytes. Large yolks are reported in certain tree-frogs, and a few others, and it becomes interesting to know the type of frog which has laid these arboreal eggs. Professor J. A. Ryder to whom I submitted the dried eggs, says that the intercellular corpuscles have the truncate form usual in Batrachia."

I looked diligently for the adult batrachian in the vicinity, but failed to discover any frogs in the trees near by or in the pool. Later in the season the trees and bushes are fully alive in places with Hylidæ.

I trust some observer with better opportunities than I had in my brief and hurried visit to Nikko will solve the mysteries of the life history of these arboreal tadpoles.

EXPLANATION OF PLATE XVII.

Fig. 1. Section of nest one-third natural size, representing internal structure and position of tadpoles in the mass.

Fig. 2. Sketch presenting a view of the position of the tadpoles amidst the vesicles. (Enlarged.)